

NOTES ON THE GENUS *STENOPELMATUS* WITH
DESCRIPTION OF A NEW SPECIES
(ORTHOPTERA)

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In the course of some anatomical work which the writers were doing with two undoubtedly distinct species of *Stenopelmatus*, it became necessary to know what species were being dealt with. One of the species was of large size, with the head, thorax, and legs usually light testaceous or somewhat fuscus. This species was dominant along the Berkeley hills and rarely extended its range into the low lying coastal shelf upon which the cities of Oakland and Berkeley are situated. In the hills this species was found only on grassy slopes, overhung by an outcropping of rock which had strewn the slope with weathered fragments. Under these rocks this species constructs its burrows.

The second species was much smaller, with the head, thorax and legs usually rufo-testaceous. This species was dominant on the low, flat belt bordering the San Francisco Bay in the neighborhood of Oakland. It was seldom taken in the hills, where the large species was fairly abundant. Throughout the residence section of the city this small species is fairly common. It burrows in the loose soil in backyard gardens and constructs tunnels beneath boxes, boards, etc., which are closely pressed to the ground. When living in the hills, it occurs in the same type of habitat as does the larger species.

It was difficult to induce the large species to mate in the laboratory, but when this was done, it was found that the female pursues the male for several minutes prior to mating. The eggs of this species measure 3.7—3.8 x 2.0—2.2 mm. These insects can stridulate loudly enough to be heard at a distance of six feet. Stridulation is accomplished by rubbing the inner face of the hind femora against the opposing side of the abdomen. The smaller species mated readily in the laboratory; in this case the male rapidly pursued the female while the latter invariably retreated. The eggs of this species measure 2.9—3.1 x 1.8—1.95 mm. Stridulating organs are present and the femora are rubbed against the abdomen as in the large species,

but the human ear can but rarely detect the sound, even at close range.

A rather thorough search of the literature on the genus failed to net anything which would serve to identify these species. Hebard's table (N. Y. Ent. Soc., vol. XXIV, pp. 70-86) is by far the best, but was inadequate in definitely determining individual specimens. The spines and spurs of the hind tibiae, upon which previous taxonomic work was largely based, are so variable in size and number as to be almost worthless. Specimens of the large and small species were sent to Mr. Caudell, who says: "I should say that from the variability of the characters used they all might be either *longispina* or *fuscus*. The simplest way out would seem to be to call all specimens of this genus *Stenopelmatus fuscus* as all our crickets are now *Gryllus assimilis*."

In the collection of the California Academy of Sciences there are specimens of *S. fuscus*, *longispina* and *pictus*, about fourteen specimens in all, which were identified by Hebard, apparently on the basis of tibial spines, the relative length of metatarsus and inner apical spine of the hind tibia. This latter character, as has been pointed out, is not dependable and varies from one extreme (*S. fuscus*) to the other (*S. longispina*) in the same locality in Berkeley. From the above it would seem that there is as yet no definite character by which these two species may be separated. It is our opinion, based upon examination of such material as is available, field study, and a study of breeding habits, that *S. fuscus* and *S. longispina* are not distinct species, and that the latter name should be made a synonym of *S. fuscus*. After studying the literature, we have arrived at the conclusion that *S. fuscus* is the larger of the two species at hand and that the smaller species is as yet undescribed, probably having been overlooked in the past as a nymph.

The genus having comparatively recently lost its wings, the thorax is in an inconstant or transitional state, and relative dimensions are not to be relied upon to any great extent. The form and shape of the head is also inconstant, since the genus is subject to magacephaly and other abnormalities. The mouth-

parts, in the series examined, show no characters of value. The rugosity and dentition of the mandibles is fairly constant, except as use reduces the teeth. The ovipositor is of some value, when used comparatively. The male genitalia consist of a fleshy bursa copulatrix which seemingly presents no characters of value, and in any case is too difficult to preserve to be of value in identifying cabinet material. The punctuation of the head shows differences of some value. Color is apparently not very reliable, varying from very light to dark in the same locality. In preserved specimens, unless in alcohol, it has been difficult to use measurements of the abdomen because of the great shriveling of the parts in drying. By injection and hardening these soft parts may be preserved in more or less their natural condition, but the size and shape of the abdomen varies much with the condition of the insect, whether or not full of food, eggs, parasites, etc. In general, the females are large and full-bodied. The males are usually somewhat smaller, with the legs longer and the abdomen smaller in proportion and laterally compressed.

The characters which we have found to be of most value in distinguishing between *S. fuscus* Hald. and *S. intermedius* n. sp. are the shape of the anterior plate of the prosternum, the size and shape of the stridulating plates on the inner surface of the hind femora, punctuation of the head, basal antennal joints, and size. A number of attempts were made to interbreed *S. fuscus* with *S. intermedius*. *S. intermedius* males were placed with *S. fuscus* females and *S. fuscus* males with *S. intermedius* females, but in no case did mating occur. No difficulty was experienced in breeding each species within itself.

STENOPELMATUS FUSCUS Hald.

Punctures distinct along the frontal (epicranial) suture, especially above and below the oblique arms between the eyes. On either side with two vertical lines of punctures, one just behind the eye and inclining slightly medially above, the other about halfway between the eye and the suture; these thin out above, but attain the vertex and in most cases extend to the anterior margin of the pronotum; angle at which the two oblique arms meet the frontal suture fairly obtuse; oblique arms nearly straight, their apparent ending being near the upper margin of the insertion of the basal antennal joint. Oblique sutures themselves wide and depressed. At and above the

fronto-clypeal suture, with a triangular depressed rugose area, the sculpture tending to run in oblique lines from the center outward and downward. Punctuation in some immature specimens sparse, rarely failing to attain the vertex; lines of punctuation behind the eyes sometimes nearly lacking. Blades of the ovipositor, in comparison with *S. intermedius*, somewhat longer, less rounded and not so heavy when viewed from the side, when viewed dorsally, meeting at a more acute angle. The basal antennal joints, while somewhat variable may prove to be of some value; in general, the third joint is subequal to the second, both together being equal to the first, the fourth being one-third as long as the third.

The shape of the prosternum, while somewhat variable, seems to be constant enough to be of some value, at least in separating the forms from any one region. It is divided into a large basal plate, with wing-like lateral areas separated by postero-lateral notches and a shallow longitudinal groove, and a smaller anterior plate, separated from the basal by a deep groove. Basal plate large, flat, truncate posteriorly; lateral notches quite sharp; grooves between the middle and lateral plates shallow and ill-defined; lateral plates rather sharp, narrowing anteriorly; anterior plate smaller, posterior margin regularly arcuate, postero-lateral angles evenly rounded, the whole lateral and anterior margin forming an even curve. In some specimens the anterior plate is semicircular, and in a few the anterior margin is squarely truncate, but in the majority of cases this plate is not more than twice as wide as long, and in many cases is noticeably less.

Stridulating organ* consisting of very small, raised, chitinous plates on the inner surface of the hind femora, compactly grouped on the basal portion of the femur near its upper or anterior margin; these plates arranged in rows which may be either straight or slightly wavy, the direction of the rows being at an angle of about 30 degrees with a line connecting the coxa and base of tibia (vertex of the angle toward the coxa); the width of the rows varies from 10 to 12 microns, but this variation cannot be correlated with age. In young or recently moulted specimens the plates rise to a blunt point on their free margins; in older specimens wear has reduced the free margin to a smooth flat curve, or to a straight line. The plates are in contact with one another laterally.

	Maximum	Minimum	Mean
Length of hind tibiae, ♀	17.0 mm.	12.0 mm.	15.0 mm.
Length of hind tibiae, ♂	19.0	17.0	18.0
Length of notum, ♀	9.0	8.0	8.3
Length of notum, ♂	9.0	9.0	8.3
Total length, ♀	48.0	42.0	45.5
Total length, ♂	37.0	35.0	36.0

* Mr. C. D. Duncan (Ent. News, vol. xxxiv, No. 3, p. 74) figured the differences in stridulating plates as a sexual difference in *S. longispina* Brunner. Since we find both of these types of plates in both males and females this cannot be a sexual difference. We would place his female (fig. B) in *S. intermedius* and his male (fig. A) in *S. fuscus*. Duncan's figure B resembles very closely the stridulating plates of specimens from Pasadena, which superficially resemble *S. fuscus*.

Stenopelmatus intermedius Davis and Smith, n. sp.

Punctuation of head sparse, the lines of punctures barely attaining the vertex; a diffuse finer punctuation over the whole frons in addition to the coarser punctuation of the sutures and punctate lines. Angle of junction of the frontal suture somewhat more acute, the oblique arms curved, their apparent ending being above the insertion of the basal antennal joints, the sutures themselves very fine and even. Rugose area above the fronto-clypeal suture somewhat larger in proportion, the rugosity transverse rather than oblique. Third basal antennal joint longer than second, both together being subequal to the first, the fourth one-third as long as the third. Ovipositor of female shorter, stouter, more rounded, more abruptly curved upward as seen from the side, the blades meeting at a more obtuse angle (about 40-45 degrees) as viewed dorsally. Basal plate of prosternum fairly large, the postero-lateral notches wider and more rounded; posterior margin squarely truncate in the female, evenly rounded in the male; lateral plates wider in proportion, not so much narrowed anteriorly, the posterior angles directed more laterally; anterior plate narrow, at least two and one-half times as wide as long, its posterior margin regularly arcuate, the anterior usually squarely truncate, sometimes rounded. Stridulating organ occupying the same location on the hind femur as in *S. fuscus*; plates arranged in rows but the rows not as distinct. It is not possible to assign a definite line of direction to these rows since the plates are more or less equally spaced, and seem aligned in several directions. Width of the row (measured from the free margin of a plate to the free margin of a plate in the adjacent row) varying from 14 to 20 microns; variation in width of a row not correlated with age; free margins of the plates smooth curves, far more strongly arcuate, without a blunt tooth arising at the crest of the curve; not reduced to a straight line by wear, each plate standing apart from all its neighbors, with no contact laterally; the distance between plates varying from 2 to 4 microns. Fine secondary punctuation of the frons almost lacking in some specimens; in most with a fine sculpture, the result of scratching by earth particles while digging. Length of the basal antennal joints varying, the third, in some cases, being subequal to the second and the fourth from one-fourth to one-third as long as the third. In some specimens (especially males) the posterior margin of the basal plate of the prothorax is rounded, but in most cases it is squarely truncate, and in some specimens it may be slightly emarginate. The anterior margin of the anterior plate is also subject to some variation, but in all cases observed is at least slightly truncate.

	Maximum	Minimum	Mean
Length of tibiæ, ♀	7.5 mm.	6.0 mm.	6.9 mm.
Length of tibiæ, ♂	8.1	7.8	8.0
Length of notum, ♀	5.0	4.0	4.6
Length of notum, ♂	4.5	4.5	4.5
Total length (dry), ♀	48.0	42.0	45.5
Total length (dry), ♂	37.0	35.0	36.0

Holotype, ♀, (No. 1875), Oakland, California, December, 1925, and allotype, ♂ (No. 1876), Oakland, California, December, 1925, in the California Academy of Sciences. Three pairs of paratypes from the same locality are to be deposited, one pair in each of the three following museums: United States National Museum, Philadelphia Academy of Natural Science, and Entomological Department of the University of California.

These specimens were undoubtedly mature, since they successfully copulated before they were killed. This species might at first be taken for a form intermediate between *S. fuscus* and *S. pictus*. According to the characters of Hebard's table it would come under *S. longispina*, the spination of the hind tibiæ being the same as that given for that species. In size and general appearance this species more closely resembles *S. pictus*, except that the dark lines on the front are lacking.

STENOPELMATUS PICTUS Scud. *

Heavy punctuation of the head practically lacking, the secondary punctuation extremely fine and sparse. Frontal sutures much as in *intermedius*, as is the rugosity above the fronto-clypeal suture. Basal antennal joints about the same, except that the fourth is only one-fourth as long as the third. Ovipositor of the female longer, less stout, the angle formed by the joining of the apices of the blades more acute. Basal plate of the prosternum somewhat arcuate posteriorly, the lateral plates quite wide, their posterior angles rounded and not laterally directed. Anterior plate very transverse, about seven times as wide as long, fairly regularly arcuate posteriorly, sinuately truncate in front.

* Since these notes were prepared we have had an opportunity to examine a specimen of *S. pictus* from Suisun, California, sent by Dr. Stanley Freeborn, and a series of eleven specimens taken in lower Panoche Canyon, Fresno County, California, by Mr. F. W. Wymore and Dr. E. C. Van Dyke.

The specimen from Suisun agrees closely with the characters stated previously. Those from Panoche Canyon agree in all except the shape of the anterior prosternal plate, which, in this series, varies from transverse and very short to nearly triangular; the black markings of the head and thorax, however, are very distinctive. This species on the whole is somewhat larger than *S. intermedius*. As these specimens were all dead when received there has been no opportunity for observation of habits and mating reactions.

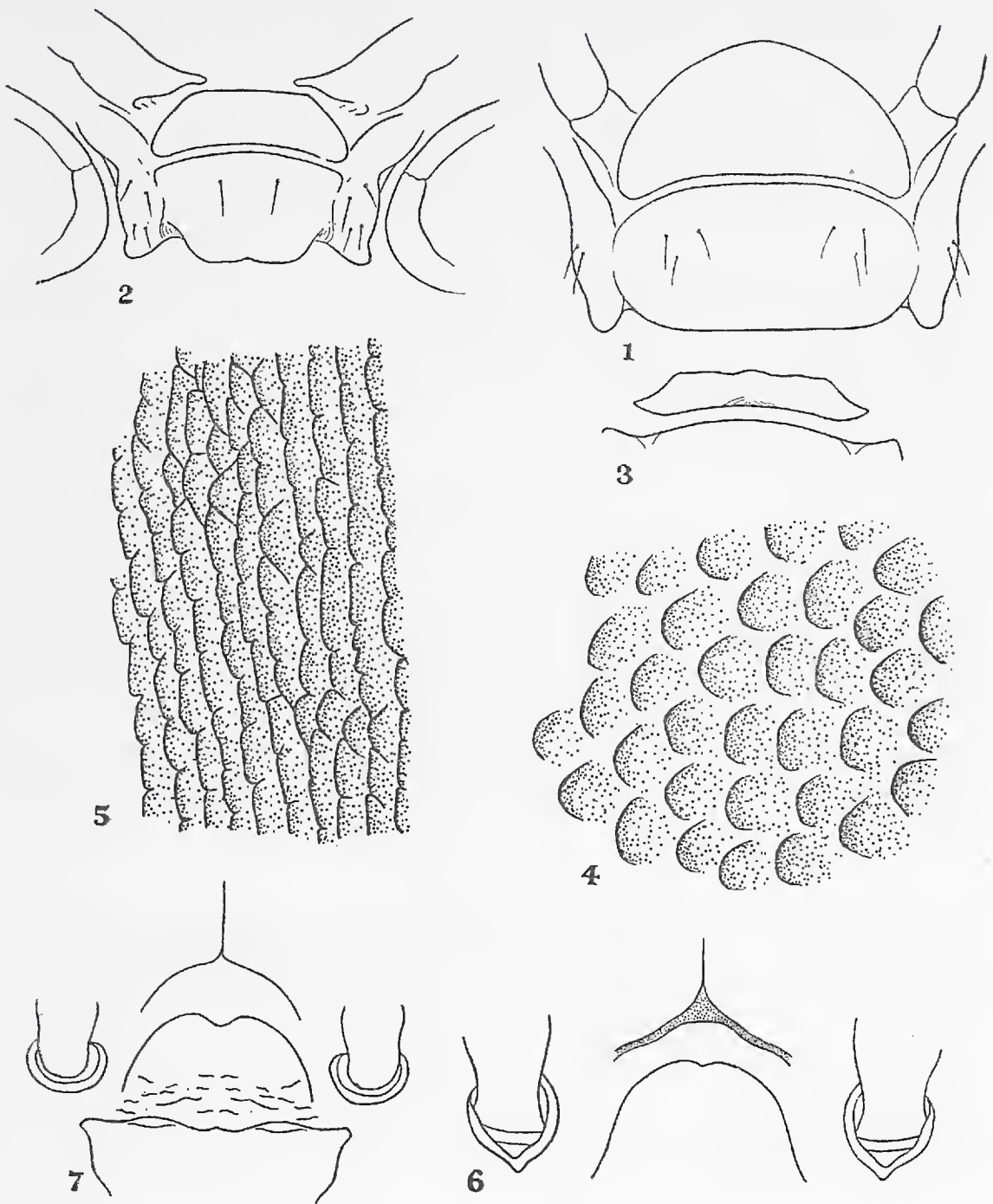
Length of hind tibiæ, ♀, 6.5 mm.; length of notum, ♀, 4.0; total length, ♀, 21.0.

There are no specimens available from which to make slides of the stridulating plates, but it is to be expected that these would resemble those of *intermedius* quite closely. The only specimen of *S. pictus* available for examination at present is a female in the collection of the California Academy of Sciences, taken by E. P. Van Duzee in San Francisco, April 11, 1919. This specimen was determined as *pictus* by Hebard in 1920 but is marked "atypical." The presence of the dark lines on the head serve, however, to distinguish it immediately from *S. intermedius*.

PREPARATION OF SOFT-BODIED INSECTS

In mounting such soft-bodied insects as *Stenopelmatus* (Orthoptera) for the cabinet, it is found that great difficulty is experienced in preventing the abdomen from shriveling to such an extent as to be useless for measurement or other identification. Removing the viscera through a ventral longitudinal suture and filling the abdomen with cotton has been tried, with indifferent success. I have found that by injecting the specimen hypodermically with 95 per cent alcohol and then immersing in alcohol of the same strength for a month or six weeks, very satisfactory results may be obtained, the abdomen shriveling only to a very slight extent. Formalin or some other rapidly hardening agent might be used with about the same or a little better success.—Alonzo C. Davis.

After a recent severe outbreak of the oak moth (*Phryganidea californica*) at Mill Valley, California, I placed a handful of the chrysalids in a container. At one average inspection there were five moths and fifty parasites (*Ephialtes behrensi* Cress.) in the box. Later some small Tachinids and a few *Chalcis ovata* emerged. This would indicate a high rate of parasitism.—E. P. Van Duzee.



EXPLANATION OF FIGURES

Fig. 1, Prosternum of *Stenopelmatus fuscus*; 2, same of *intermedius*; 3, anterior prosternal plate of *pictus*; 4, stridulatory plates of *intermedius*; 5, same of *fuscus*; 6, frontal sutures of *fuscus*; same of *intermedius*.